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TWO NEW SPECIES OF *ELEUTHERODACTYLUS* FROM
WESTERN COLOMBIA
(AMPHIBIA: ANURA: LEPTODACTYLIDAE)

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Although the frog genus *Eleutherodactylus* predominates the amphibian fauna of northwestern South America, few species are known from the Colombian Andes (Cochran and Goin, 1970; Duellman, 1979). This is surprising in view of the greater complexity of the Colombian Andes compared to those of Ecuador where a rich eleutherodactyline fauna is found (Lynch, 1979, 1981; Lynch and Duellman, 1980).

Recent field work reveals that there are actually many species of this genus on the two western cordilleras of Colombia. The two species described below are members of the large and cumbersome *unistrigatus* Group (Lynch, 1976). One species is restricted to the Cordillera Occidental (having a distribution like that of *E. viridicans*; Lynch, 1977) whereas the other occurs on both cordilleras.

In the accounts below, the following abbreviations are used: E-N, eye to nostril distance; HW, head width; IOD, interorbital distance; and SVL, snout-vent length. When significantly different, means are reported as the mean \pm 2 standard errors. The term Assembly is applied to subgroups of the *unistrigatus* Group, following Lynch and Duellman (1980).

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Eleutherodactylus boulengeri new species

HOLOTYPE.—UMMZ 166565 (field number IJ 6001), an adult male obtained 3 km (airline) SW Cerro Munchique, Departamento de Cauca, Colombia, 2520 m, on 11 July 1965 by K.K. Alder, C. Elton, F.C. Lehmann, and H. and P. Trapido.

PARATYPES.—(all from Colombia). Departamento de Cauca: Topotypes, UMMZ 166566-71 (IJ 6002-06, 6009); Munchique, 2740 m (KU 144046); Puracé, 2920 m (KU 169050-54); Departamento de Huila: 14.5 km WNW Leticia, 2540 m (KU 169056-61); 35 km E Puracé, 2840 m (KU 144050-52). Departamento de Tolima: Juntas, ca 20 km NW Ibaqué, 2750 m (ICN 3266, 3270-71, 4794-95). Departamento Valle de Cauca: 7 km NE Tenerife, 2850 m (KU 169062).

The following 83 specimens were collected in the Parque Nacional de Puracé, Sector de Chupallal de Perico, but are not designated paratypes.—Colombia, Departamento de Huila: 29.4 km (by road) NW San José de Isnos, 2600 m (ICN, JDL 11517-65); 39 km (by road) NW San José de Isnos, 2880 m (ICN, JDL 11626-58, 11690).

DIAGNOSIS.—1) skin on dorsum finely granular, that of venter areolate; no dorsolateral folds; 2) tympanum prominent, round, its length $1/3 - 1/2$ eye length; 3) snout subacuminate in dorsal view, acutely rounded in lateral profile (papilla at tip); 4) upper eyelid narrower than IOD, bearing non-conical tubercles; low cranial crests in adult females; 5) vomerine odontophores oblique; 6) males with subgular vocal sac; non-spinous nuptial pads on thumbs of males; 7) first finger shorter than second; discs broad, on dilated pads, pads larger than tympanum; 8) fingers lack lateral fringes; 9) ulnar tubercles prominent; 10) non-conical tubercles on heel, none on outer edge of tarsus; inner tarsal tubercle or fold present; 11) two metatarsal tubercles, inner oval, 3-4 times size of round outer; numerous supernumerary plantar tubercles; 12) toes bear narrow lateral fringes; toe pads as large as those of fingers; 13) dorsum pale brown with darker brown interorbital bar and mottling; venter cream; posterior surfaces of thighs pale brown; limb bars absent or diffuse; canthal-supratympanic stripe dark brown; 14) adults moderate-sized, males 18.6-25.6 ($\bar{x} = 22.1 \pm 0.3$, $n = 87$) mm, females 27.3-33.8 ($\bar{x} = 30.0 \pm 1.0$, $n = 17$) mm SVL.

Eleutherodactylus boulengeri most resembles *E. phoxocephalus* Lynch and the frog called "Ruthven's *cruentus*" by Lynch (1978). From *E. phoxocephalus*, *E. boulengeri* is distinguished in having uniformly brown posterior surfaces of the thighs (rather than marbled black and yellow), a papilla on the tip of the snout (rather than a vertical keel), and

tubercles on the upper eyelid and heel. Ruthven's "*cruentus*" has sharp canthi rostrali, short dorsolateral folds, and outer tarsal tubercles. Additionally, it is slightly smaller than *E. boulengeri* or *E. phoxocephalus*.

DESCRIPTION.—Head as broad as body (slightly narrower in gravid females), wider than long; HW of males 34.4-38.9 ($\bar{x} = 36.9 \pm 0.5, n = 20$) % SVL, of females 34.9-39.8 ($\bar{x} = 38.0 \pm 1.1, n = 8$) %; snout subacuminate (with pointed tip) in males in dorsal view, more rounded (with pointed tip) in females in dorsal view, acutely rounded (with pointed tip) in lateral profile (Fig. 1); tip bearing papilla; nostrils weakly protuberant, directed dorsolaterally; E-N of males 75.8-91.2 ($\bar{x} = 82.0 \pm 2.3, n = 20$) % eye length, of females 80.6-100.0 ($\bar{x} = 88.9 \pm 4.0, n = 8$) %; canthus acutely rounded, weakly concave; loreal region concave, sloping gradually to lips; lips weakly flared; interorbital space broader than upper eyelid; upper eyelid of males 80.8-96.7 (\bar{x}

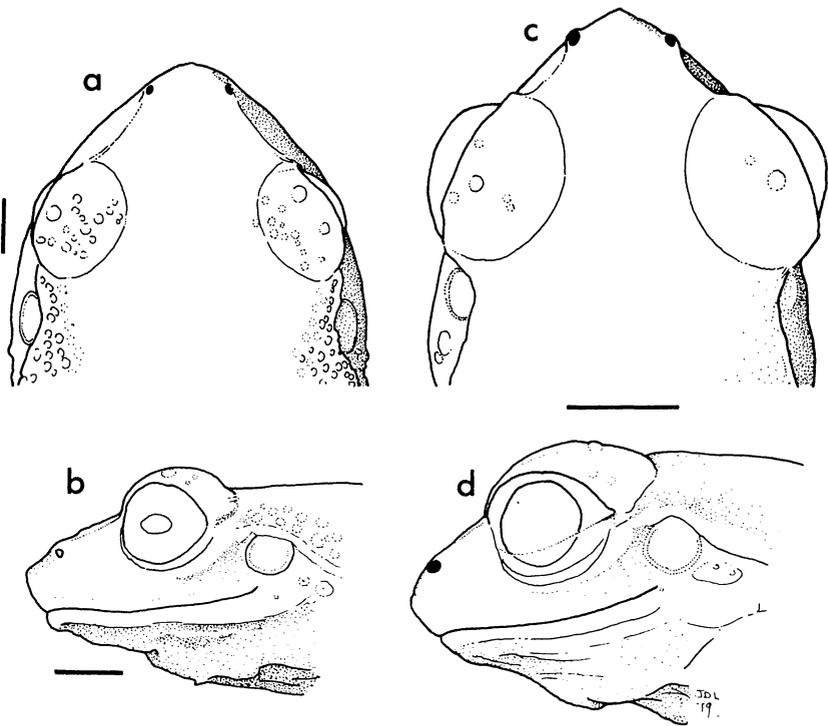


Fig. 1. *Eleutherodactylus boulengeri* new species (a) top of head, KU 169055, (b) side of head, holotype; *E. brevifrons* new species (c, d) ICN 5212. Lines equal 2 mm.

= 88.5 ± 2.4 , $n = 20$) % IOD, of females 71.8-89.7 ($\bar{x} = 81.9 \pm 4.6$, $n = 8$) %; edges of frontoparietals upturned in adult females, generally flat (without prominent furrow); upper eyelid bearing 1-6 non-conical tubercles; temporal region sloping, tympanum directed posterodorsolaterally; tympanum length of males 30.8-46.6 ($\bar{x} = 40.0 \pm 1.8$, $n = 20$) % eye length, of females 36.8-52.8 ($\bar{x} = 44.8 \pm 4.0$, $n = 8$) %; tympanum prominent, round, separated from eye by less than its own diameter (Fig. 1), upper edge sometimes concealed by supratympanic fold; postrictal tubercles moderate-sized; choanae round, moderately large, not concealed by palatal shelf of maxillary arch; vomerine odontophores median and posterior to choanae, oblique in males, more teardrop-shaped in adult females, bearing 2-5 teeth in oblique to transverse row, each odontophore smaller than a choana, separated by a distance equal to a choanal width; tongue longer than wide, posterior 2/5 - 3/5 not adherent to floor of mouth, posterior edge shallowly notched; males with long vocal slits posterolateral to tongue; large external, subgular vocal sac.

Skin of dorsum finely granular, no dorsolateral folds; flanks more areolate, venter coarsely areolate, discoidal folds prominent, ending well anterior to groin; skin on lower and posterior thigh areolate; no subanal warts; anal opening not extended; ulnar tubercles non-conical, prominent; palmar tubercle bifid, larger than oval thenar tubercle; supernumerary palmar tubercles numerous, low; outer edge of palm bearing large supernumerary tubercles (Fig. 2), subarticular tubercles round to broader than long, non-conical; fingers lacking lateral fringes; all fingers bearing broader than long discs on dilated pads, pads rounded apically; pads on fingers II-IV larger than tympanum, that on I smaller than tympanum; thumb shorter than second finger; non-spinous pads on thumbs in males.

Knee and heel bearing 3-5 non-conical tubercles; rarely any tubercles along outer edge of tarsus; inner edge of tarsus bearing elongate tubercle (ridge-like) or fold for distal 1/3 of tarsus; inner metatarsal tubercle non-compressed, 1 1/2 times as long as wide, 3-4 times size of round outer metatarsal tubercle; supernumerary plantar tubercles numerous, non-conical; subarticular tubercles round, non-conical; toes bearing narrow lateral fringes, not basally webbed; all toes with discs (much broader than long) on broad pads; toe pads as large as those of fingers, rounded apically; heels of flexed hind legs overlap; shank 46.2-54.8 ($\bar{x} = 50.9$, $n = 28$) % SVL (sexes not different).

Dorsum pale brown with darker brown interorbital bar and mottling; (other individuals striped, see below); limbs not or diffusely banded; limb bands narrow, perpendicular; dark brown canthal-

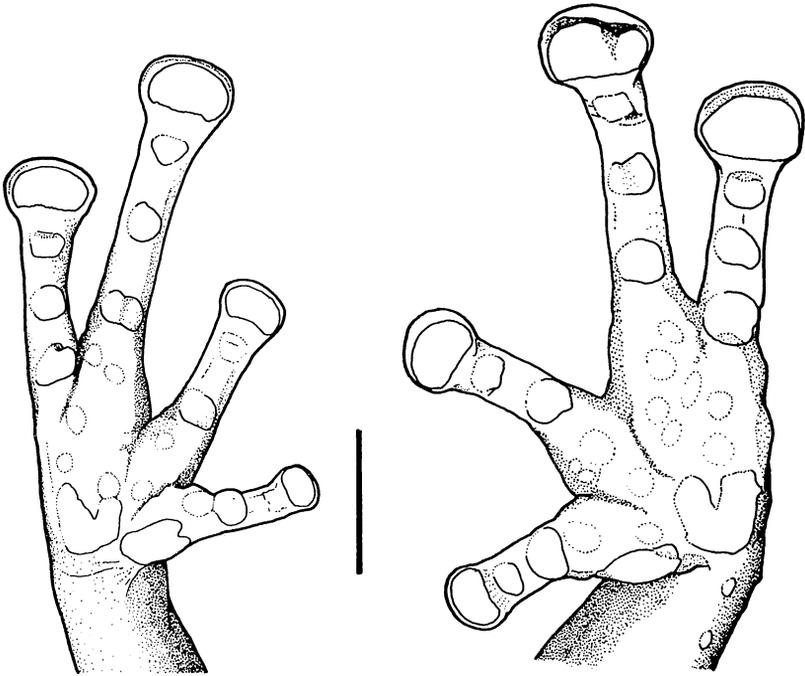


Fig. 2. Hands of *Eleutherodactylus brevifrons* (left, UMMZ 166574) and *E. boulengeri* (right, KU 144041). Line equals 2 mm.

supratympanic stripe; labial bars indefinite or obliterated by white labial stripe; flanks pale cream to white without markings; anal triangle diffuse; posterior surfaces of thighs washed with rusty-brown; venter cream with or without indefinite gray suffusion.

In life, dorsum orange-tan to brown; spots darker (mostly browns), sometimes replaced by longitudinal stripes; in some females the brown spots are edged with cream; throat of males pale yellow; ventral surfaces dusky cream in males, pale brown in females; anterior and posterior surfaces of thighs yellowish-brown to brown; iris copper to reddish-brown, flecked with dark brown or black; bearing a reddish-brown horizontal streak.

The specimens from the Parque Nacional de Puracé (sector Chupalal de Perico) exhibit the following color morphs:

Morph 1 (see fig. 3a): pattern of spots, sacral chevron, occipital W, and interorbital bar (39 males, 12 females). One of the females has a hairline vertebral stripe superimposed on the above pattern.

Morph 2 (see fig. 3b): pattern of longitudinal stripes, no interorbital bar (12 males, 5 immature females). Two of the males have hairline

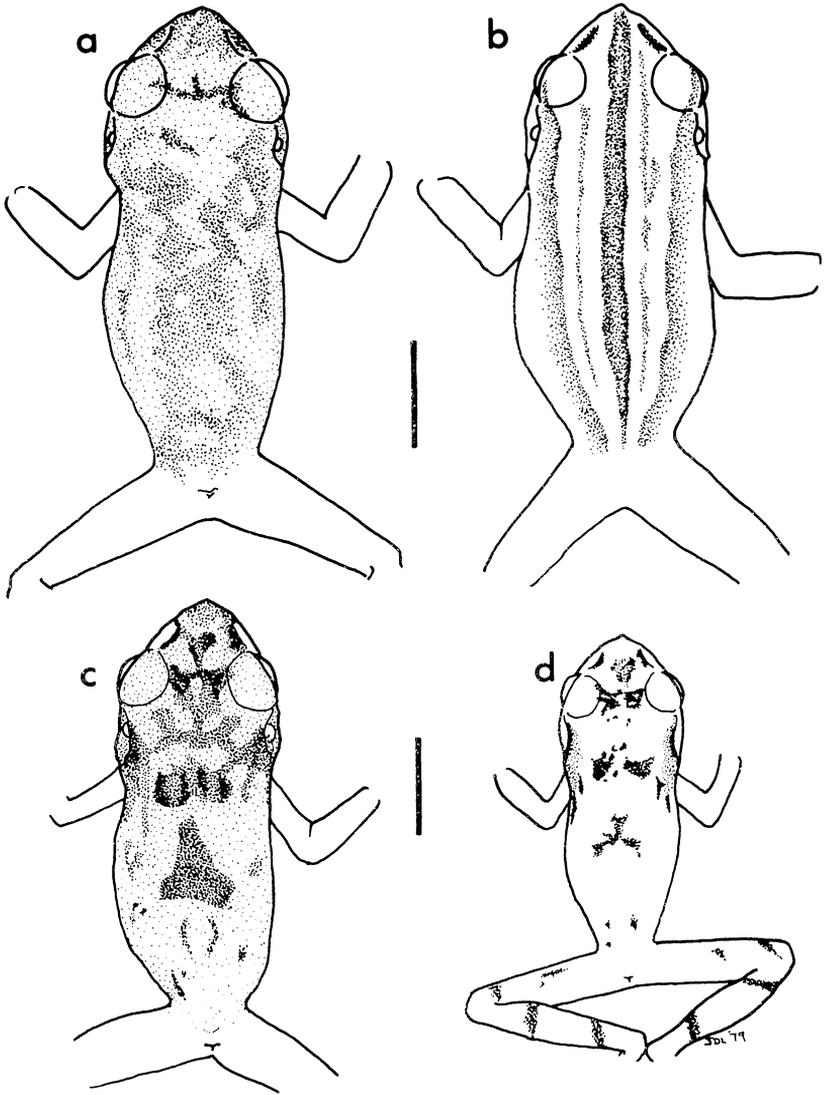


Fig. 3. Color patterns of *Eleutherodactylus boulengeri* (a, UMMZ 166567; b, UMMZ 166568) and *E. brevifrons* (c, UMMZ 166572; d, UMMZ 166581). Lines equal 5 mm.

vertebral stripes within the dark vertebral stripes.

Morph 3: dark dorsolateral stripes; area between stripes tan; no interorbital bar (2 males, 2 females). Two other males have partial paravertebral stripes and the anterior one half of a dark vertebral stripe (and are thus intermediate between Morphs 2 and 3).

Morph 4: dark dorsolateral stripes and brown dorsum; dorsolateral stripes edged dorsally by thin pale stripes; no interorbital bar (2 males, 1 female).

Morph 5: pale middorsal raphe (broad) edged with black; laterally on dorsum are brown blotches; interorbital bar present (2 males).

Two other individuals (1 male, 1 female) are probably minor variants of Morph 1. In these frogs, the occipital W is expanded to form a broad brown chevron and the markings on the lower back are condensed to form a sacral triangle and a postsacral blotch on a pale tan background. Each of three other males exhibits unique color patterns. One is unicolor brown above with a fine, hairline vertebral stripe. The other two have blotches of enamel-like cream (edged with dark brown)—one on the head and the other on the sacrum. In each case, other dorsal markings are poorly expressed.

MEASUREMENTS OF HOLOTYPE IN MM.—SVL 24.5; shank 11.8; HW 8.7; head length 8.4; upper eyelid width 2.8; IOD 3.1; tympanum length 1.2; eye length 3.0; E-N 2.4.

ETYMOLOGY.—Named for George Albert Boulenger, the nonpariel herpetologist.

NATURAL HISTORY.—KU 169061 is a juvenile male, 13.5 mm SVL, lacking nuptial pads and vocal slits. The largest juvenile females are KU 169051 and UMMZ 166568, 26.4 and 24.3 mm SVL, respectively.

My field experience with *E. boulengeri* is limited to collections made in the Parque Nacional de Puracé (sector Chupallal de Perico), above San Jose de Isnos, Depto. de Huila, Colombia, in July 1980. Pedro M. Ruiz and I collected along a transect between 1950 and 3290 m. *Eleutherodactylus boulengeri* was very abundant at 2600 and 2880 m but was absent at 1950-1970 m (heavily cut-over, only patches of forest remain) and at 3090-3290 m. Its absence at the highest site is perplexing because the forest appeared to be essentially the same as that at 2880 m. Collecting in the vicinity of the INDERENA cabaña (Paletará, 3030 m) on the west edge of the Parque Nacional de Puracé (headwaters of the Río Cauca), Departamento de Cauca, did not reveal *E. boulengeri*.

On overcast or rainy days, *E. boulengeri* was actively calling but on sunny days no activity was apparent. Soon after sunset, *E. boulengeri* was the dominant component of the frog choruses. Amplexant pairs were found on 20-21 July 1980; both females have ovulated. The call consists of a single explosive "peep" (occasionally grouped as 4-5 peeps). Males call from atop leaves 0.5-2.5 m above the ground. Few females were found at night (possibly because collectors were constantly distracted by calls from males). During the day, most individuals were found in terrestrial and arboreal bromeliads. Only females were found beneath rocks.

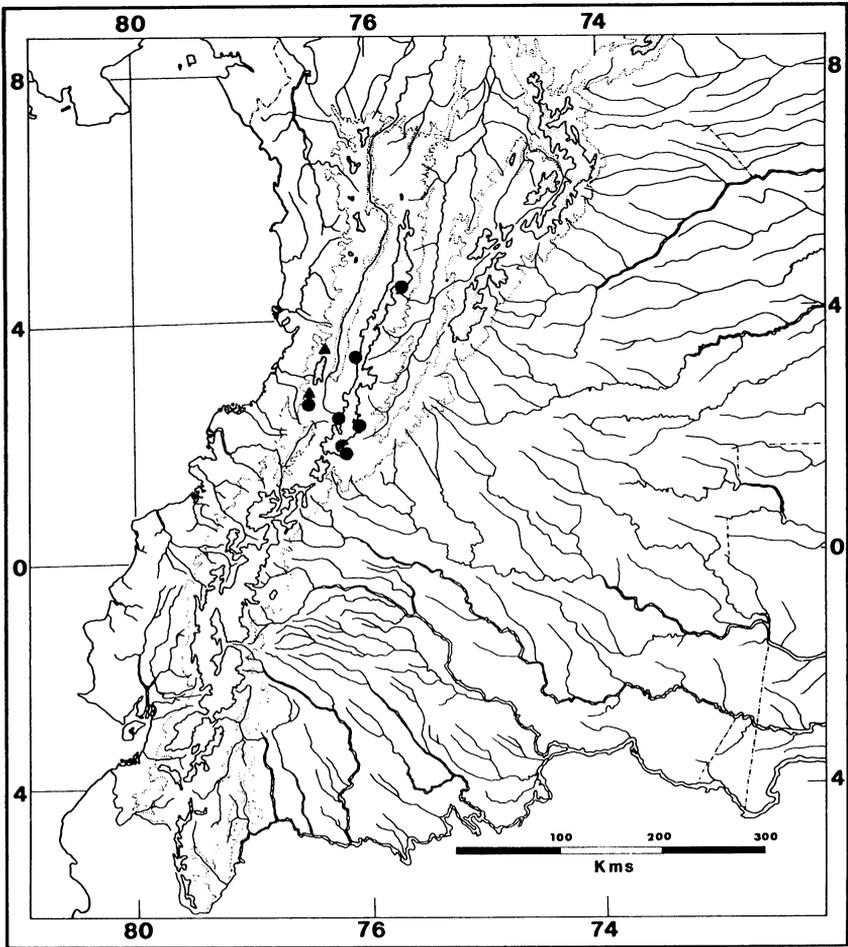


Fig. 4. Map showing known distributions of *Eleutherodactylus boulengeri* (circles) and *E. brevifrons* (triangles).

DISTRIBUTION.—The southern portions of the Cordillera Central of Colombia (2540-2920 m) in high cloud forests. Also known from Cerro Munchique (2520 m) on the Cordillera Occidental of Colombia (Fig. 4).

Eleutherodactylus brevifrons new species

HOLOTYPE.—UMMZ 166572 (field number IJ 6053), obtained 15 km WNW Cali [=Cerro San Antonio (also known as TV tower mountain)], Departamento Valle de Cauca, Colombia, 2050 m, on 17 July 1965 by K.K. Adler and W. Moberly.

PARATYPES.—UMMZ 166573-81 (IJ 6050-52, 6054-56, 6058-59, 6073), ICN 5212-29 (JDL 11363-84), MCZ 86029-33, topotypes; KU 169006-13, W slope Cerro Charquayaco, 38 km NW Uribe, Departamento de Cauca, Colombia, 2240 m.

ALSO EXAMINED.—Colombia, Departamento de Cauca: “La Romelia,” 20 km (by road) NNW Uribe, 2610 m (ICN, JDL 12072, 12220-26); Pozo Azul, 24 km (by road) NNW Uribe, 2530 m (ICN, JDL 12106-07); Quebrada Sopladero, 33 km (by road) NNW Uribe, 2190 m (ICN, JDL 12169-70).

DIAGNOSIS.—1) skin of dorsum smooth to very finely shagreened, that of venter areolate; no dorsolateral folds; 2) tympanum concealed beneath thin skin, its length $1/3$ - $1/2$ eye length; 3) snout subacuminate in dorsal view (papilla at tip), protruding at lateral profile; canthus rostralis moderately sharp; 4) upper eyelid usually narrower than IOD, bearing tubercle; no cranial crests; 5) vomerine odontophores absent, or if present, small, oblique; 6) males with subgular vocal sac and vocal slits; no nuptial pads on thumbs of males; 7) first finger shorter than second; discs broad, on dilated pads, pads as large as tympanum; fingers long and slender; 8) fingers bear narrow lateral fringes; 9) ulnar tubercles present; 10) non-conical tubercles on heel, inner edge of tarsus; 11) two metatarsal tubercles, inner oval, 3-4 times size of subconical outer; numerous supernumerary plantar tubercles; 12) toes bearing narrow lateral fringes; toe pads as large as those of fingers; 13) pale brown above with dark brown markings; posterior surfaces of thighs brown; venter immaculate except for brown stippling along edge of lip; 14) adults small, males 15.1-19.7 (\bar{x} = 17.4 \pm 0.3, n = 46) mm, females 21.2-25.0 (\bar{x} = 22.8, n = 5) mm SVL.

Superficially, *E. brevifrons* resembles *E. petersi* Lynch and Duellman (a member of the *lacrimosus* Assembly), but differs in having tubercles on the knee and heel, protruding snout, and smaller digital pads. *Eleutherodactylus brevifrons* is thought to be related most closely to *E. boulengeri*, *E. phoxocephalus*, and Ruthven's “*cruentus*”, but is readily distinguished from each by its small size and protruding snout.

DESCRIPTION.—Head narrower than body (gravid females), or as broad as body (males, juvenile females), slightly wider than long; HW 33.1-37.1 (\bar{x} = 35.2, n = 21) % SVL; snout subacuminate with papillate tip in dorsal view, protruding in lateral profile; E-N 64.2-91.4 (\bar{x} = 77.4, n = 21) % eye length; nostril weakly protuberant, directed dorsolaterally; canthus rostralis moderately sharp, concave; loreal region concave, sloping abruptly to lips; lips not flared; interorbital space flat, broader than upper eyelid; upper eyelid 77.7-106.6 (\bar{x} = 88.0, n = 21) % eye length; upper eyelid bearing a few indefinite tubercles (Fig. 1);

temporal region sloping; supratympanic fold prominent, extending to base of arm; tympanum higher than long, distinct, directed posterolaterally, separated from eye by less than one half its length; tympanum length of males 32.1-46.7 ($\bar{x} = 42.1 \pm 2.9, n = 14$) % eye length, of adult females 42.6-54.5 ($\bar{x} = 49.7, n = 5$) %; postrictal tubercles small; choanae relatively large, round, not concealed by palatal shelf of maxillary arch; vomerine odontophores absent, or if present, small, oblique, separated by a distance equal to 1 1/4-2 choanal widths, each 1/3-1/4 size of a choana, median and posterior to choanae, bearing a clump of 2-3 teeth; tongue slightly longer than broad, its posterior edge notched, posterior 2/5 not adherent to floor of mouth; males with long vocal slits posterolateral to tongue, large external subgular vocal sac.

Skin of dorsum smooth to very finely shagreened, that of flanks warty, no dorsolateral folds; some short folds on anterior flank; skin of venter areolate, discoidal folds prominent, well anterior to groin; vent not extended in sheath; ulnar tubercles non-conical; palmar tubercle bifid, larger than oval thenar tubercle; palmar supernumerary tubercles flat; subarticular tubercles round to slightly broader than long; fingers bearing indefinite, narrow lateral fringes; all digits bearing discs (broader than long) on dilated pads; pads rounded apically, that on thumb not dilated, others appreciably so; pads of fingers III-IV as large as or slightly larger than tympanum, of I-II smaller than tympanum; fingers long and slender (Fig. 2), thumb shorter than second finger; no nuptial pads on thumbs of males.

Knee and heel bearing small, round tubercles, outer edge of tarsus lacking tubercles; inner edge of tarsus bearing 1-3 tubercles; inner metatarsal tubercle twice as long as wide, non-compressed, 3 times size of subconical outer metatarsal tubercle; supernumerary plantar tubercles prominent, round, most on 3rd and 4th metatarsals; subarticular tubercles smaller than those of fingers, round, not elevated; toes bearing indefinite lateral fringes, not webbed; all toes bearing discs (broader than long) on dilated pads; toe pads as large as those of fingers, rounded apically; heels of flexed legs (held at right angles to body) just overlap; shank of males 48.5-56.2 ($\bar{x} = 53.2 \pm 1.1, n = 14$) % SVL, of females 47.0-52.6 ($\bar{x} = 50.0 \pm 1.6, n = 7$) %.

Pale brown above and on limbs with dark brown interorbital triangle, scapular and sacral blotch; canthal and supratympanic stripes prominent; limb bars transverse, one half width of interspaces; posterior thigh pale brown; lower flanks, anterior thigh, and venter immaculate.

In life, *E. brevifrons* is pale yellow to brown above with indistinct to bold, brown markings washed with green; upper eyelids pale green; throat of males bright yellow; venter pale greenish-white; undersides

of limbs pale yellow; iris copper flecked with black and bearing reddish-brown horizontal streak; tympanum pale bronze; facial markings olive.

A striped pattern (similar to that in Fig. 3b) occurs in *E. brevifrons* but most individuals are spotted (Figs. 3c-d); the spots are of varied intensities.

MEASUREMENTS OF HOLOTYPE IN MM.—SVL 22.3; shank 11.0; HW 7.7; head length 7.2; upper eyelid width 2.2; IOD 2.7; tympanum length 1.3; eye length 2.5; E-N 2.2. The holotype is gravid and has strongly convoluted oviducts.

ETYMOLOGY.—Latin, *brevis* (short), *frons* (brow), in reference to the short snout.

NATURAL HISTORY.—A juvenile male (ICN 5229) is 12.4 mm SVL. The largest juvenile females (UMMZ 166576 and 166579) are 20.0 and 20.2 mm SVL, respectively. On 6 July 1979, 22 individuals were collected along the road on Cerro San Antonio between 2000 and 2100 m. *Eleutherodactylus brevifrons* were conspicuous in that males were calling from the vegetation other than ferns and always in sites that were out from under a forest canopy. Males perched on leaves 1-3 m above the ground. The call is a single, sharp, "peep." A slightly larger species (undescribed) was found only on vegetation inside the forest. *Eleutherodactylus erythropleurus* (Boulenger) was found everywhere at the site whereas *E. thectopternus* Lynch and *E. w-nigrum* (Boettger) were found on the ground in forested areas.

In the Parque Nacional Natural "Munchique," calling males were found in exposed sites as well as along the forest edge (but not near streams). Adler found the UMMZ specimens in bromeliads by day.

DISTRIBUTION.—High cloud forests (2050-2610 m) on the western slopes of the Cordillera Occidental in west-central Colombia (Fig. 4).

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LITERATURE CITED

- COCHRAN, D.M. and GOIN, C.J. 1970. Frogs of Colombia. Bull. U.S. Natl. Mus. (288): 1-655.
- DUELLMAN, W.E. 1979. The herpetofauna of the Andes: patterns of distribution, origin, differentiation, and present communities, pp. 371-459, in Duellman, W.E. (ed). The South American Herpetofauna: Its Origin, Evolution and Dispersal. Mus. Nat. Hist. Univ. Kansas Mono. (7):1-485.
- LYNCH, J.D. 1976. The species groups of the South American frogs of the genus *Eleutherodactylus* (Leptodactylidae). Occas. Pap. Mus. Nat. Hist. Univ. Kansas (61):1-24.
- _____. 1977. A new species of *Eleutherodactylus* from the Cordillera Occidental of Colombia (Amphibia: Anura: Leptodactylidae). Occas. Pap. Mus. Zool. Univ. Michigan (678):1-6.
- _____. 1978. A new eleutherodactyline frog from the Andes of northern Colombia (Leptodactylidae). Copeia 1978(1):17-21.
- _____. 1979. Leptodactylid frogs of the genus *Eleutherodactylus* from the Andes of southern Ecuador. Univ. Kansas Mus. Nat. Hist. Misc. Publ. (66):1-62.
- _____. 1981. Leptodactylid frogs of the genus *Eleutherodactylus* in the Andes of northern Ecuador and adjacent Colombia. *Ibid*, *in press*.
- _____. and DUELLMAN, W.E. 1980. The *Eleutherodactylus* of the Amazonian slopes of the Ecuadorian Andes (Anura: Leptodactylidae). *Ibid.*, (69):1-86.

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